

REMARKS

It is noted that, notwithstanding any claim amendments made herein, Applicants' intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1, 3-22, and 31-33 are all of the claims pending in the present Application. New claims 31-33 are added. It is noted that no excess claims fee is involved, since such fee was earlier paid for claims that the Examiner withdrew from consideration.

Claim 7 stands rejected under 35 USC §112, second paragraph, as being incomplete for omitting essential elements. Applicants believe that the amendment above addresses the Examiner's concern and respectfully request that the Examiner reconsider and withdraw this rejection.

Claims 1, 3-17, 19, 20, and 22 stand rejected under 35 USC §103(a) as unpatentable over US Patent 5,623,181 to Suehiro et al, further in view of US Patent 6,331,063 to Kamada et al. Claims 18 and 21 stand rejected under 35 USC §103(a) as unpatentable over Suehiro/Kamada, further in view of US Patent 5,183,752 to Singer et al.

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

As described and claimed, for example by claim 1, the present invention is directed to a light-emitting diode including a light-emitting element. A lead assembly supplies electrical power to the light-emitting element. A reflection mirror is provided in an opposing relation to the light-emitting surface of the light-emitting element. A light-transmissible material seals the light-emitting element, a part of the lead assembly, and the reflection mirror. A radiation surface radiates light reflected on the reflection mirror to the outside.

The reflection mirror includes a metal mirror which is obtained by processing a metal plate to give it a concave shape or which is obtained by mirror-surface-treating the concave surface of the metal mirror formed by the processing of the metal plate. The concave-shaped metal plate has a design feature so that it is held in place as a stand-alone reflection mirror element in a molding die during fabrication of the light-emitting diode. The radiation surface is formed on the light-transmissible material at its surface at the rear of the light-emitting

element and a through-hole is formed through the reflection mirror to serve as an air escape path during an assembly of the light-emitting diode.

An advantage of the present invention is that it provides a method of mass production for LEDs, using conventional metal-forming techniques to pre-form the mirror. The metal plate provides a resistance to heat deformation during fabrication of the device as well as during the operation of the device.

The prior art references of record fail to teach or suggest using a metal plate as the starting point for an LED with a reflector or using a mass production technique for pre-forming a thin metal plate as the beginning process in mass production of an LED.

II. THE PRIOR ART REJECTIONS

The Examiner alleges that Suehiro, as modified by Kamada, renders obvious the present invention as defined by claims 1, 3-17, 19, 20, and 22 and, when further modified by Singer, renders obvious the present invention as defined by claims 18 and 21.

Applicants respectfully disagree.

First, it is noted that the claim revisions above reflect the Examiner's comments during the personal interview held on April 28, 2004. During that interview, the Examiner asserted that the position of the USPTO was that the metal deposition of Suehiro was considered equivalent to the plate-metal mirror of the present invention.

However, during the interview, the Examiner also indicated that she thought the present invention would be patentably distinguished if the claims were worded to indicate the design feature(s) of the pre-formed metal plate that allows it to be supported as a stand-alone element during assembly. The claim revisions above reflect this generic feature of the present invention, although it is noted that a number of different embodiments provide this feature in different and distinct ways, including, as non-limiting examples, protrusions, insulated standoffs applied at the rim of the mirror, and affixing the mirror to a surface as, for example, along the bottom or rim of the mirror.

Applicants also point out that the Suehiro reflector is very similar to the prior art illustrated in Figure 28 of the present Application and discussed beginning at the bottom of

page 2, as can be readily seen by comparing Figure 3 of Suehiro with Figure 28.

The concept of the resin units shown in Figure 28 suffers from a number of problems, including tearing away of the metal coat serving as the reflector, cracks of the portion 97 around the leads (intended to isolate the deposited metal 95 from the leads 92b, 92b to prevent shorting of the leads by the metal coating 95), and difficulty in preventing bubbles during formation.

In contrast, the pre-formed metal plate reflector of the present invention provides a stand-alone element around which the resin can be molded in a die during fabrication. Moreover, if the reflector has a strategically-located hole, bubbles can be precluded during molding.

The Examiner concedes that Suehiro fails to reasonably teach or suggest using a pre-formed metal plate and relies upon Kamada to overcome this deficiency.

However, Applicants point out that incorporation of a pre-formed metal reflector would change entirely the concept of Suehiro. For example, the purpose of Suehiro is to form the LED's in a multi-layered vertical structure so that there is a single plane of light emission to the exterior (see Abstract). This multi-layered structure requires that all of the upper units have a dotted transmissible reflector structure shown in Figure 4, in order to allow the light from lower units to radiate through to the surface. A metal plate reflector would preclude this transmission of light from lower stages.

Therefore, the Examiner cannot simply replace the dotted semi-transmissible reflectors with a solid metal plate reflector, since Suehiro would clearly no longer function as intended.

However, in line with Examiner Keaney's helpful suggestion during the personal interview, Applicants have amended the independent claims to more clearly describe the significance of a plate-based reflector. It is noted that, in distinction from the Examiner's comments during the interview that the present invention has a support rim that rests on a support structure, the present invention has more than a simple rim to provide the mechanism to firmly attach the reflector during the fabrication process as resin is injected into the molding die.

Therefore, these claims are generic in nature, rather than specific to any of the various mechanisms that allow the pre-formed reflector to be firmly fixed during fabrication.

It is also brought to the Examiner's attention that the configurations shown in Figures 25 and 26 of Kamada do not teach or suggest offsetting the light emitting elements off the surface of the substrate or metal reflector.

Hence, turning to the clear language of the claim, there is no teaching or suggestion in Kamada of: " ... a metal plate, pre-formed into a concave shape, that forms a reflection mirror, said reflection mirror provided in an opposing relation to the light-emitting surface of said light-emitting element, said light-emitting element mounted a predetermined distance from a reflective surface of said reflection mirror, said concave-shaped metal plate having a design feature so that it is held firmly as a stand-alone reflection mirror in a molding die during a fabrication of said light-emitting diode...", as required by claim 1. The remaining independent claims have similar language.

Applicants also request, should the Examiner maintain the rejection based on Suehiro, as modified by Kamada, that the Examiner provide a reasonable reference that supports the Examiner's alleged benefits of replacing the metal-deposited reflectors of Suehiro with plate-metal reflectors and that support the Examiner allegation that a through hole provides the benefit of preventing distortion.

The Examiner relies upon Singer for demonstrating a UV LED, but this reference does not overcome the deficiencies identified above for Kamada and/or Suehiro.

For the reasons stated above, the claimed invention is fully patentable over the cited references.

Further, the other prior art of record has been reviewed, but it too, even in combination with the Suehiro, Kamada, or Singer, fails to teach or suggest the claimed invention.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicants submit that claims 1, 3-22, and 31-33, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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